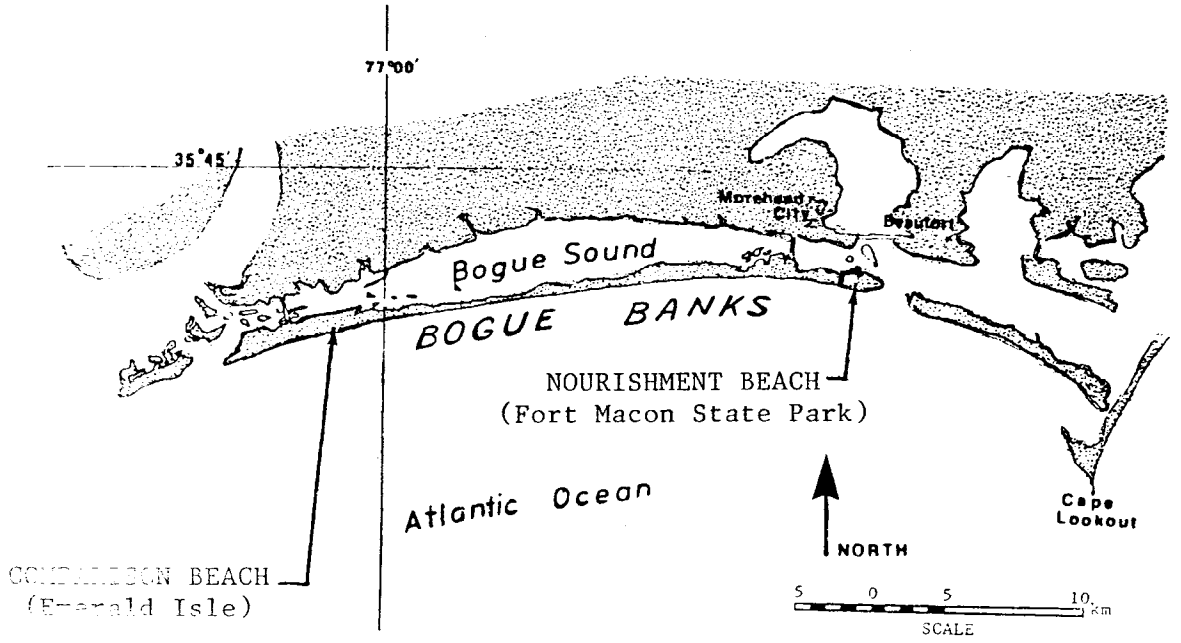
Coastal Engineering Technical Note

BIOLOGICAL EFFECTS OF BEACH RESTORATION WITH DREDGED MATERIAL ON THE MID-ATLANTIC COAST

PROBLEM: The Corps of Engineers is involved in beach restoration as an alternative to or in conjunction with structural methods of halting beach erosion. The use of dredged material for beach restoration is beneficial in two ways. A disposal site is provided and the material helps restore an eroding beach. However, the Corps must assess the impact of this nourishment on beach ecology and the additional stress it may create on the ecosystem. See CETN-V-3, CETN-V-5, and CETN-V-7 for results of similar studies on the Gulf of Mexico, South Atlantic coast, and Pacific coast, respectively.

EFFECTS OF BEACH RESTORATION: An estimated 1.18 million cubic yards of maintenance dredged material was pumped on Fort Macon Beach, North Carolina from December 1977 to June 1978. The location is shown below.



Bogue Banks, North Carolina showing the Study Sites

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 1982		**00-00-1982 to 00-00-1982**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Biological Effects of Beach Restoration with Dredged Material on the Mid-Atlantic Coast	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Corps of Engineers (USACE),Coastal and Hydraulics Laboratory,3909 Halls Ferry Road,Vicksburg,MS,39180**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**3**	

The material came from the deepening and widening of the Morehead City State Port Harbor. It contained large quantities of clay, fine particles, and shell which were considerably different than the natural beach sediments. Clay-formed balls persisted until eventually worn away, slowly leaching fine particles of sediments into the water. The nourishment operation caused high turbidity and increased the total solids in the nearshore water column many times that of the background level. Although the dredged sediments contained trace metals, there was no increase of these metals.

Fort Macon Beach was studied before, during, and after beach nourishment for a total of 20 months to evaluate the ecological impacts of using dredged meterial for restoration of the beach. A beach not undergoing nourishment at Emerald Isle was concurrently sampled as a control. This analysis is based on five typically high energy sandy beach benthic organisms: *Emerita talpoida, Donax parvula, Donax variabilis, Haustorius* spp. and *Scolelepis squamata*. The nourishment operation began in the winter and extended through the spring. This was the period of major recruitment of beach animals following their winter population low.

The initial impact of the nourishment operation was to either kill benthic animals by covering them with the dredged sediments or drive the motile species away. Because of the continuous disposal operation and leaching of the fine sediments from the beach during the spring, benthic animals that were recruited by pelagic larval stock were drastically reduced in numbers and only a few motile recruits returned to the beach after nourishment. The recruitment of beach animals at Fort Macon Beach was delayed about two months as compared to the control beach at Emerald Isle. Animals most affected by the nourishment were those that spend their entire life-cycle in the beach sands. Migratory consumers (fish and shellfish) usually in the surf zone were also severely reduced in numbers and did not return in their original abundance after the operation ceased. The high turbidity and lack of prey was suggested as the reason for the low populations of consumers in the surf.

CONCLUSIONS:

1. Beach animals recruited from pelagic larval stock were inhibited from returning to the beach during the spring portion of the nourishment operation because of high turbidities and sedimentation.
2. Animals that spend their entire life-cycle in the beach sand were most seriously impacted by beach replenishment.

3. Nourishment destroyed or drove away the intertidal macrofauna; but, based on other regional studies, recovery should occur within one or two seasons.
4. Consumer (fish and crabs) abundance was reduced during the beach nourishment operations because of high turbidities and sedimentation and the loss of prey.
5. Dredged sediments to be used for replenishment should be those that minimize turbidities. It would be desirable for the beach fill material to have grain sizes as large or larger than the natural beach sediments.
6. Replenishment operation during the winter would reduce the effects of planktonic larval recruitment and migratory species that return to beaches from offshore during the spring.
7. This study suggests that projects smaller than one-half mile would probably recover more quickly than larger projects since recruitment from nearby beaches would be easier.

ADDITIONAL INFORMATION: Contact the CERC Coastal Ecology Branch, (202) 325-7393.

REFERENCES:

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